

# **Student Seminar and TRB Conference Attendance II**

By

Dr. Michael Anderson  
Department of Civil and Environmental Engineering  
The University of Alabama in Huntsville

Dr. Daniel Turner  
Department of Civil and Environmental Engineering  
The University of Alabama

and

Dr. Virginia Sisiopiku  
Department of Civil and Environmental Engineering  
The University of Alabama at Birmingham

Prepared by

# **UTCA**

University Transportation Center for Alabama  
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The University of Alabama at Huntsville

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<b>16. Abstract</b>  Students from the three campuses of the University of Alabama of System are engaged in a variety of transportation related research activities. This project provided a forum for these transportation students to present their research results to faculty and students from their home campuses as well as transportation practitioners in a professional setting.  The students were selected to make the presentations by faculty representatives, based upon competitive abstracts. They were rewarded with travel funding to attend the Transportation Research Board 2005 Annual Meeting in Washington D.C.					
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## Contents

Contents.....	iii
Figures .....	iii
Executive Summary .....	iv
1.0 Introduction .....	1
2.0 Selection of students .....	2
3.0 Student Seminar .....	4
4.0 TRB attendance .....	6
5.0 Conclusions .....	8
Appendix A - Abstracts Submitted by Students Selected to Make Presentations .....	9

## List of Figures

Number		Page
Figure 2-1	Announcement for UAH students. ....	2
Figure 3-1	Student presenters .....	4

## List of Tables

Number		Page
Table 3-1	Student presentation information .....	4

## **Executive Summary**

There were two main activities conducted in this project. First, students from the three University of Alabama System campuses needed an opportunity to present the results of their research in a professional forum. Second, they would benefit from attending an international professional meeting to learn first-hand research work being conducted at other universities. This project addressed these issues by identifying deserving students to attend a forum to highlight their research work, and by providing a means for these student to attend the Annual Meeting of the Transportation Research Board to explore other research work performed worldwide.

## **Section 1**

### **Introduction**

The activities conducted in this project were twofold. First, there were many high-quality transportation research projects being performed by undergraduate and graduate students working through the University Transportation Center for Alabama (UTCA). These students were located at The University of Alabama (UA), The University of Alabama at Birmingham (UAB) and the University of Alabama in Huntsville (UAH). Unfortunately, no mechanism existed for the students to present the results of their research to the other faculty members from either their home campus or the other campuses. This project addressed that situation by developing a transportation student seminar track as part of the Second UTCA Research Symposium. This year, the student seminar track consisted of two unique sections: a formal paper presentation for the top student selected at each school and a poster session for the other deserving students. Students from the three campuses were required to submit an original abstract and resume to a transportation faculty member at their home schools. These faculty members formed a review board, and selected students to present papers at the technical session.

The second issue addressed in this project was sending UTCA's best students to the Transportation Research Board (TRB) 2004 Annual Meeting in Washington D.C. This meeting is one of the premiere transportation conferences in the world. Attendance at this meeting enabled the students to experience, firsthand, research topics being studied and the solutions to those topics. Attendance at this meeting represented an incredible opportunity for students from the University of Alabama System to learn about the future of transportation and how their research will contribute to future transportation systems.

This project combined these two issues by awarding travel funds to students to attend the TRB Meeting as a reward for being selected to present in the student seminar track.

This report is divided into five chapters. The introduction presents the basis of the project. Chapter two discusses the selection and review process used to select students to present their papers. Chapter three provides a review of the student seminar. Chapter four presents the impact from the students attending the TRB Annual Meeting. The final chapter provides overall results and establishes expectations for student seminars in the future.

## Section 2 Selection of students

The initial task for this project focused on advertising and selecting the students to give presentations at a seminar designed to highlight student research work. The advertising was accomplished through an announcement requesting students to submit an abstract of their potential research work for consideration of presentation at the student seminar. A sample announcement (used at UAH) is shown in Figure 2-1. Copies of the announcement were distributed to each of the campus representatives for the project. On each campus, a faculty member posted the announcements, generated interest among students, and fielded questions from students. Dr. Virginia Sisiopiku coordinated the collection of abstracts at UAB, and R. Dan Turner coordinated the abstracts at UA.

### UAH Students Interested in Transportation

The University Transportation Center for Alabama (UTCA) is sponsoring a student research competition with a chance to earn a trip to the annual Transportation Research Board Meeting in Washington D.C., January 2005.

Anyone interested in the UTCA student research competition needs to submit an abstract of current or proposed research and a resume to Dr. Michael Anderson by July 31, 2004. The abstract must be less than 500 words and detail a transportation related project. From the submitted abstracts, three students will be selected to prepare a brief paper on their work and present their results at a student research seminar this fall. Those students will receive money to attend the annual Transportation Research Board Meeting in Washington D.C., January 2005 and will be required to prepare a brief summary report. Full-time students enrolled through the spring semester of 2005 are eligible.

For more information, please contact Dr. Michael Anderson in the Department of Civil Engineering at 824-5028 or [mikea@cee.uah.edu](mailto:mikea@cee.uah.edu).

**Figure 2-1 Announcement for UAH students**

Each announcement requested that abstracts and resumes be submitted to the appropriate on-campus representative. The reviews of the abstracts and resumes were performed by the two on-campus representatives who were not on the student's home campus. This removed some bias from the reviews, as individual faculty members who worked closely with students on projects, were not allowed to judge those students. A ranking system was developed that examined the resume, abstract importance, and writing ability of the students. The reviews from the representatives were then forwarded to Dr. Anderson, summaries were developed, and letter of

acceptance to present a paper at the conference or to present a poster at the conference were sent to the students.

Overall, 14 students, representing the three campuses, submitted abstracts and resumes for the program (four from UA, five from UAB, and five from UAH). Based on the travel funds and seminar time available, three students (one from each campus) were selected to present formal papers at the seminar and receive funding to attend the TRB Annual Meeting, six students (two from each campus) were selected to present posters at the seminar and receive funding to attend the TRB Annual Meeting, and the remaining students were invited to present posters at the seminar without receiving travel funds. However, after the selection process was completed, there was a reduction in presenters due to an instance where a selected presenter was offered and accepted a full-time position, removing him from the seminar. The eight “selected” abstracts may be found in Appendix A of this report.

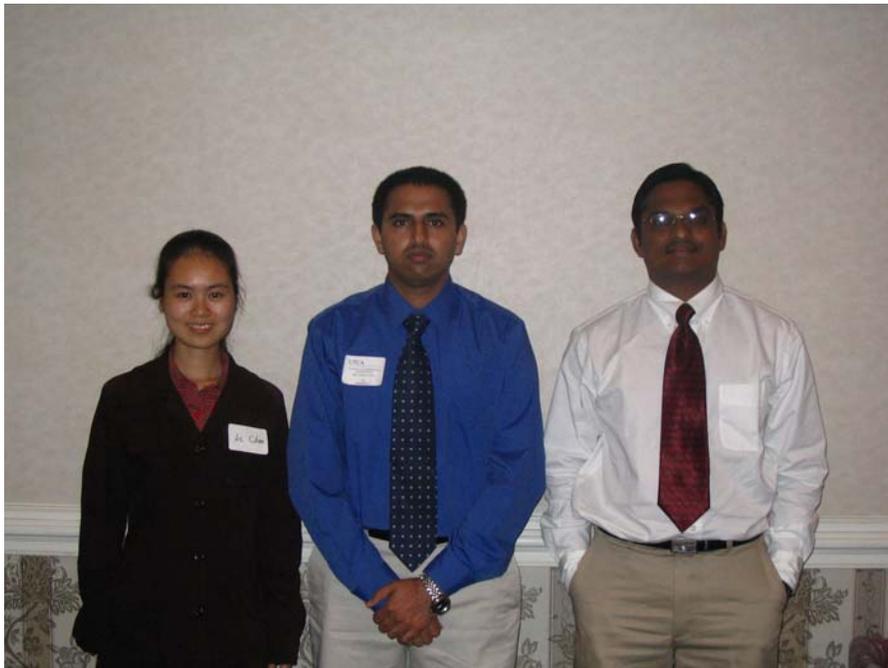
### Section 3 Student Seminar

The second task conducted in this project was to host a student seminar track as part of the UTCA Research Symposium, conducted at the Holiday Inn Homewood, Birmingham, AL. This location was easily accessible to students and faculty from the three campuses, as well as representatives from around the state. The names of the student presenters, titles of presentations and associated home campus are shown in Table 3-1. Figure 3-1 shows the selected students:

**Table 3:1 Student presentation information**

UA Student		
Li Chen	Civil Engineering	“Safety Evaluation of Rumble Stripes on Highways in Alabama”
UAB Student		
Vishal Patil	Civil Engineering	“Risk Assessment Analysis for HAMAT Trucks in Alabama”
UAH Student		
Pachhava Vengal Rao	Computer Science	“Mobility Information Management System (MIMS)”

**Figure 3-1 Student presenters (Li Chen, Vishal Patil, Vengal Rao, left to right)**



The student paper session was part of a tract during the afternoon of the Symposium. Mr. Charles Robinson from UAB moderated the session, which were attended by approximately 20 faculty and students from the three campuses, managers of the Alabama Department of Transportation, and representatives from local transportation agencies. After the technical session, a poster session was held to allow students who were not selected to give formal presentation a chance to display their research.

## **Section 4**

### **TRB attendance**

The final portion of this project was student attendance at the TRB Conference in January 2005. This was a “reward” for those students selected to give presentations or posters at the UTCA Research Symposium. Before attending the TRB Meeting, students were required to prepare an itinerary of sessions and committee meetings they intend to visit during the meeting. These were discussed with their on-campus representatives to ensure that students had selected the most applicable portions of the huge TRB meeting. Some of the session topics that were identified by the students included:

- Curved steel bridges,
- Pavement management systems,
- Access management,
- Toll-booth simulation,
- Transportation safety,
- Signing and marking,
- Traffic simulation, and
- Intelligent transportation systems

Each student attending the TRB Meeting was required to prepare a written summary of the sessions attended, and to explain the relationship between the selected sessions and his or her current research interests. Sample quotes from the student summaries included:

- “By attending the joint meeting of Traffic Control Devices Committee and Signs and Markings Committee, I get to know what other people are doing in pavement markings, to be specific, rumble stripes and rumble strips, which is my current research topic. It helped a lot in my own research, telling me whether I was on the right track, whether I had some new findings or different results compared with theirs. I got to know other people’s methods of data analysis, which encouraged me to think of whether my own method was good enough or not.”
- “The one thing I liked about this session is the elaborative information they gave about their project. The session on the “Current Issues and Challenges Facing Pavement Management Systems” was very helpful to me in understanding the details of a good pavement management system. The session on the “transportation from the customer’s perspective “helped to think of new features, which can be added to my information system. Overall, it was a great learning experience for me in attending the different sessions, and I thank one and all for giving me this opportunity...”
- “The TRB conference had a workshop and a technical paper session specifically for curved bridges. I had an opportunity to meet some of the experts in my area of research.

This provided good exposure to discuss my research with them and to get their suggestions for improvement. Also, the work shop presented an overview of the latest specifications that will be released later this year. This helped me understand the latest changes and the current trend in the specifications. In addition, I attended different sessions related to bridge fabrication, construction and behavior.”

Overall, the students took advantage of the opportunity to learn from top researchers and to identify how those research ideas could be incorporated into their work.

## **Section 5 Conclusions**

This project furthered the professional development of a community of students from the three campuses, highlighted the work these students were performing, and provided a means to explore other research work being performed nationwide.

The relevance of this project was far reaching. The project allowed students from the three campuses to compete against each other and to present their research results in a professional forum, attended by transportation professionals from across the state. In addition, this project allowed students to learn first-hand what research topics were being examined internationally through attendance at the TRB Annual Meeting. The students' experiences and education gained through this project is anticipated to enhance graduate level work being performed at all three campuses.

## **Appendix A**

### **Abstracts Submitted by Students Selected to Attend TRB**

## **Safety Evaluation of Rumble Stripes on Highways in Alabama**

By Li Chen

Department of Civil and Environmental Engineering, UA

### **Abstract**

The Critical Analysis Reporting Environment (CARE), software created to analyze data from traffic crashes in Alabama, shows that 4634 fatal crashes occurred during 1999 – 2003 in Alabama, with 2012 of these crashes being run-off-road crashes. Run-off-road crashes account for more than 40% of the deaths and serious injuries on the highways in Alabama. Pavement markings help drivers stay on the road and in the proper lane, so effective application of pavement markings is one of the ways to reduce run-off-road crashes and to improve highway safety.

Problems with the conventional flat pavement markings include a lack of warning to drivers as they drift off the highway, and the reduced visibility during nighttime and on wet pavements. Traditional rumble strips have proven very successful in reducing run-off-road crashes. Edgeline pavement markings applied over rumble strips, called rumble stripes or Modified Edge Striping (MES), are being examined by the Alabama Department of Transportation (ALDOT) as a possible further step in the solution to the problems.

Since July 2003 seven ALDOT projects have included rumble stripes. The rumble stripes encompass 43.931 miles on rural and urban highways in eight counties in Alabama. UTCA project 04405 will provide a quantitative assessment of the effectiveness and usefulness of these “rumble stripes” and a comparison of rumble stripes to two other types of roadway edge markings used in Alabama: flat thermoplastic markings (FTM) and profiled pavement markings (PPM).

This study will evaluate the wet-night visibility, service life, life-cycle costs and crash rates of rumble stripes in Alabama, and will compare rumble stripes data to the data already amassed for FTM and PPM in UTCA project 01465. The rumble stripes on the seven ALDOT projects will be measured for nighttime dry and wet retroreflectivity using a mobile retroreflectometer, and then compared with retroreflectivity of the FTM and PPM. The approach to assess the safety effect of these rumble stripes is the before/after crash evaluation with a comparison group. The primary objective of this evaluation is to find whether there is a relationship between the introduction of rumble stripes and a reduction in crash rate. Life cycle cost analysis will be conducted to decide whether economics, marking service life, and crash rate justify use of one pavement marking in preference to another.

The results of this work will help ALDOT select among three types of edge stripes: MES, FTM and PPM.

## **Progressively Phased Bridge Inspection**

By James Haynie

Department of Information Systems, Statistics, and Management Science, UA

### **Abstract**

To grapple with the ever increasing demand on bridge inspection resources, a research study was undertaken to determine how best practices and lessons learned from statistical quality control could be leveraged to more effectively manage the process of bridge inspections at a system-wide level. Coupled with the increased number of bridge inspections, costs related to retrofitting bridges with automated sensors along with a constrained pool of qualified inspectors are straining limited maintenance budgets. In the worst-case scenarios, predictions have been made that bridges with no safety defects will be restricted or closed solely because they have not been inspected in a timely manner. Consequently, alternative processes to the current bridge inspection practices must be identified and implemented to preserve the level of public safety and reduce the strain on the inspection pool.

This presentation introduces the Progressively Phased Bridge Inspection Program. The program investigates the use of a reduced inspection set which is based off the present condition of a defined bridge structure. The result is a process in which the initial stages of a bridge's lifespan have a limited inspection group of elements identified. To meet intermediate inspection criteria, the group of elements is utilized to safely and accurately estimate the condition of the structure by identifying relationships with other elements within the bridge structure. This limited inspection set behaves as a quality control process. Within the quality control process, additional related items required for inspection are generated and allow the monitoring of the condition of the bridge structure to ensure its safety. The control limits set through this process form bands, grouping different sets of elements to be used in the inspection process at a given period of time throughout the life of the structure. The result is a base inspection set that increases and evolves throughout the life of the structure; over the years, more items will be inspected due to predetermined deterioration levels.

Implementation of such a process could result in a significant decrease in the amount of inspection time for defined bands of bridges, while still meeting safety regulations. Likewise, this work provides empirical support for determining best placement for automated sensors to gain the most prediction power for a range of bridge elements.

**Stability of Curved I-Girder Bridges During Construction**  
By Mahendrakumar Madhavan  
Department of Civil and Environmental Engineering, UAB

**Abstract**

There has been a notable increase in the number of horizontally curved steel bridges, primarily due to the ever-lasting emphasis on aesthetics coupled with land and/or transportation alignment restrictions. The I-shape plate girder is one type of section commonly used in the superstructure. In the case of a bridge with straight girders, for example, torsion can be ignored since it is considered a secondary effect and stability can be achieved by considering bending as the primary structural action. But a horizontally curved girder is subjected to significant torsional stresses, even under pure gravitational loading and cannot be neglected. Unlike a box girder, which is a closed section with high torsional rigidity, an I-section is an open section with very less torsional capacity and sometimes in the order of one thousandth of a box section. Such low torsional resistance of I-sections creates problems in lifting, handling, transportation and erecting of the girders during construction of the bridge.

Research carried out over the past 30 years was focused more on the strength issues of curved girders that come into play after the girders have been set in place with deck hardened providing complete stability against lateral torsion. Generally, problems with curved I-girder bridges result from unwanted displacements, stresses, and instabilities during lifting and erection, which are typically unaccounted for by the designer. Local buckling of curved I-girder flange plates is one such instability that could occur before overall instability of the girder could take place. The *AASHTO Guide Specifications for Horizontally Curved Bridges* lack proper definitions of flange slenderness to prevent flange local buckling. The slenderness limits for flanges in the *Guide Specifications* are based on limited experimental data obtained from idealized loading and boundary conditions. Furthermore, the slenderness limits in the *Guide Specifications* do not converge to straight I-girder flange plates in the *AASHTO Standard Specifications* as the radius of curvature approaches infinity.

The present research is focused on evaluating the reduction in buckling capacity of curved I-girder flange plates. Using theoretical and finite element approaches slenderness limits for flange plates have been developed. The model developed reduces to the AASHTO straight girder slenderness limit when the radius of curvature approaches infinity.

**Risk Assessment Analysis for HAZMAT Trucks in Alabama**  
By Vishal Patil  
Department of Civil and Environmental Engineering, UAB

**Abstract**

In 2001, large trucks made up three percent of all registered vehicles in the United States while accounted for eight percent of vehicles in fatal motor vehicle crashes, and two percent of vehicles in injury crashes. Of those large trucks, four percent of trucks involved in fatal crashes and two percent of trucks involved in nonfatal crashes were carrying hazardous materials (HM). HM was released from the cargo compartment in about one-sixth of these crashes (16 percent). The nationwide statistics confirm that accidents involving HM are low in frequency but high in consequence. HM can pose a great danger to environment and humans and often involve spills, fires, and explosions with potentially catastrophic effects. Therefore it becomes important to better understand the magnitude of the problem, identify the factors contributing to such crashes, and determine countermeasures to reduce them.

This paper presents results from a study that analyzed HM truck safety risks and impacts for the state of Alabama. A risk assessment methodology was developed and used to identify the likelihood of occurrence of an accident that involves a truck transporting hazardous materials. The analysis was performed over a ten-year period (1993-2002) using detailed crash records and CARE, a data analysis software package designed for problem identification and countermeasure development purposes. Moreover, the economic impact of crashes involving HM trucks was assessed for the state of Alabama. Finally, the statewide findings were compared with nationwide trends to determine the relative severity of the HM truck safety problem in Alabama. The analysis performed and the insights gained from the study results can be used by decision makers to make informed safety investment decisions for addressing the HM truck safety problem in the future.

## **Mobility Information Management System (MIMS)**

By Vengal Rao

Department of Computer Science, UAH

### **Abstract**

A major research challenge is to design and develop large-scale information management system that can provide the right information to the right people at the right time interactively and securely. Information becomes ubiquitous, highly distributed and at the same time accessible from everywhere at any time. The goal of this project is to focus on the deployment of MIMS methodology, using a database and Internet pages as a statewide implementation so that transportation information can be acquired, understood and utilized by general public.

The first step in the development of this project was the collection of the data related to transportation resources and operation. A survey report was developed based on the collected data and in data was worked in the second phase. The second phase involved development of front-end pages where the input data was entered and stored it in the database. The front end for dissemination of the results from the database through the Internet was through Active Server Pages. The interactive web-page system is easy to implement for a novice user, then he can get the desired information in no time. The third step in the development of the MIMS system was related to extending access to ubiquitous information, through a secured and more advanced methodology for the end user and authorized agencies. The inclusion of the update screens on the Internet pages with a security feature enabled the agencies to remove old data and add the new transportation services. The authorized agencies will have the right to access the database where they can add new information, and update old information so that the client will have the exact updated information.

The first screen of this project is a Alabama State map (<http://almims.uah.edu>). The user can select the region where he is located. It transfers him to a next screen with all the nearest neighbors to his location. This selection will provide the user with all the transportation service segmented into various types of transportation identified from the trip purpose menu. The trip menu itemizes the types of trips the user can select. Upon selection of any of these menu options, the system will advance the user to a screen showing a list of available services for the specific type of transportation selected. If the user needs specified detail from the list, he can click on the record by entering the ID and can get detailed information in the following page. This system is so interactive that he can get direct contact with the list of numbers provided for the service.

We have made this online system a secure one so that only authenticated users can have permission to update new data and delete old information, bringing the transportation services up to date.

The MIMS project is a user-friendly interface where a common-man who has minimum knowledge of accessing Internet pages can get the valuable information in planning a safe and sound trip. The whole system provides the public information on the transportation services within the state and also helps the transportation agencies help passengers in arranging their trips. The system is helpful to both the transportation agencies that need to maintain the data, and to the general user that desires information on transportation related services offered in the region.

The final database will be available to assist Alabama residents in planning, arranging and making trips within the state.

## **Simulation of Access Management Treatment near Rural Interchangers**

By Kapilkumar Sharma

Department of Civil and Environmental Engineering, UAB

### **Abstract**

As a part of the Corridor X access management and development plan, micro simulation is being used to find the effect of access management (AM) on corridor-X, which is intersected by the state and county highways in northwest Alabama. The state and county highways have potential for future development which will attract more traffic and directly affect the traffic on corridor-X. The purpose of the project is to develop subdivision regulations that require AM for development in the immediate vicinity (2.5 mile buffer zone) of the interchanges. Traffic simulation is being used to find different access management alternative which can decrease the impact on traffic on corridor X. Out of available alternatives the most appropriate one will be suggested. The traffic simulation result (outputs, animation, technical report, etc.) will be used to get technical, political and public favor along the corridor.

The simulation will be performed to a 2025 planning horizon. All corridor X and cross street traffic will be forecasted using the regional model developed by the Regional Planning Commission of Greater Birmingham (RPCGB). Addition volume will be added according to a trip-generation model developed else where in the project. The resultant future traffic will be modeled with and without AM treatments. Relative measures of effectiveness will be compared to evaluate the benefits of the treatments. Also the animation capabilities of the simulation will be used to identify operational problems such as excessive queuing on the off ramps from Corridor X. This will greatly aid in the development of new subdivision regulations that foster proper access management.

## **Identification of Hot Spots and Driver Age Effect in Crashes using Quality Tools and Statistical Tests**

By Anupama Susarla

Department of Industrial System Engineering and Engineering Management, UAH

### **Abstract**

Road accidents are often concentrated over particular stretches of road or at certain intersections or junctions. This is not by chance, but because of factors such as road layout and structure, the types of traffic, road surface conditions and the behavior of road users. Identification of these accident-prone locations was the first stage of any accident study. According to Alabama Traffic Accident Facts in 1997, a typical Alabamian driver has a 37.8% chance of being injured or killed in a road accident. There were 45,205 total accidents that occurred in Madison County, Alabama from the years 1998 to 2002. The details of each accident are contained in a data set that accommodate the Critical Analysis and Reporting Environment (CARE) software. Segmental accidents and intersection accidents differ in their accident patterns, causes for the accidents and the types of the accidents. Hence the analysis was done by first dividing the accidents into segmental accidents and intersection accidents. Since the cost involved in an accident depends on the severity of the accidents, a severity index was given to each segment/intersection in Madison County. The severity indices were calculated based on the severity of the accident. The higher the severity index the greater the likelihood severe injury or death. Hence the severity indices are ranked from highest to least. Based on the severity index, hot spots in Madison County, Alabama have been identified. After the identification of the hot spots, the significant contributing factors for the accidents at the hot spots were identified. The Kruskal-Wallis test, a statistical non-parametric test, and Pareto charts were used to identify the significant contributing factors were accidents on the hot spots. Once the significant factors have been identified, conditional probability was used to find the Driver Age effect in these accidents. The main objective of this was to identify the situations and conditions in which specific driver age groups experience high crash risk. The results from this paper provide better understanding of some of the risks and problems related to driver age. Furthermore, some other observations such as DUI accidents, pedestrian accidents, hazardous cargo accidents, etc., of Madison County were compared to other counties in the Alabama.

**Pavement Management System for County Roads in the State of Alabama**

By Jeffrey Wilson  
Department of Civil and Environmental Engineering, UAH

**Abstract**

A pavement management system is designed to store a variety of information about roadways and to allow easy viewing access to all the data. This pavement management system will be used as a network level system. A network level system looks at all the roads in a certain area, such as a county in Alabama. The main type of information stored about the roads is their current condition rating. This condition rating will be on a scale of one to ten, with one being the worst and ten being the best. It is important for county engineers to know the current condition rating of their roads, so that they can determine what roads need to be repaired first. Some of the other information that to be stored would be the average daily traffic and the percentage of trucks on the roadway. Knowing these two things would help an engineer decide what road should be prepared first. This is where easy viewing access comes into play. By being able to view all the roads based on their current condition rating, average daily traffic, and percent trucks, an engineer can find which roads need to be repaired the soonest and which roads can be put off to a future date. By keeping good records of the data, a pavement prediction model can be developed that estimates what condition the pavement would be in at some determined time in the future.